REMARKS

The following is a pretense discussing the prior art and present invention and terminology used in each document. After which, discussion of each rejection claim by claim will follow this pretense.

It can be shown that the teachings of Zendle, Carnegie, and Dent are counter to the claims of the present invention. One following the teachings of Zendle, Carnegie and Dent would not be able to construct the present invention. A review of present invention is followed by review of Zendle, Carnegie, and Dent.

The present invention provides for a means for *spatial multiple access* using the Ethernet switch and a type of antenna called a Multi-beam antenna. *Spatial Multiple access* means that the Ethernet Switch and Multibeam antenna, together, automatically provide for a multiplicity of simultaneous users to one hub. This is done using the Ethernet Switch's Media Access Control (MAC), or network, address table. The MAC, or Network, address is a unique address identifying any device connected to an Ethernet network. Each port on an Ethernet switch has a Network Address, and a Network address table. This table is a record of all devices connected to that particular port. The Ethernet switch directs network traffic by scanning a data packet's destination network address, and forwarding the data packet to the correct switch port. The Ethernet switch automatically "learns" what devices are connected to it by scanning the source network address of packets coming into the switch port, adding that source network address to that switch port's network address table, and thereafter, forwards data packets with that same address as the destination network address to that port.

By connecting a dedicated, static, antenna beam (from the Multi-beam antenna) to the one switch port, the present invention allows for the Ethernet switch to build a network address table which includes the network address for each device in each beam (the spatial area). Once the switch learns what devices are in each beam, it will automatically forward data packets to the correct beam. By providing multiple, simultaneous beams as through the Multi-beam antenna, the number of network addresses in each port's network address table can be reduced by a factor of the number of antenna beams, thereby improving data

throughput and increasing the total number of devices simultaneously served by the hub. This is a novel and unobvious approach to providing *spatial multiple access*. Zendle's teaching specifically precludes this form of *multiple access*.

Importantly, the examiner states that Zendle teaches a Multi-beam antenna and beamformer. Zendle does not use the term Multi-beam antenna or beamformer anywhere in the Zendle patent. The Multi-beam antenna, as described by the present invention, is a special class of antenna which uses a passive, reciprocal, NxN beamforming matrix to create a fixed beam. This type of Multibeam antenna is mathematically defined by the authority Allen[1] in a proof. In the cited reference, Allen concludes:

"It has been shown that for a passive, reciprocal matrix (as described in present invention) *to form simultaneous independent beams* (i.e a Multibeam antenna) *in a lossless manner, the shapes* (of the antenna beams) *must be such that their space factors are orthogonal* (fixed in position relative to each other, as described in present invention) *over the interval period of the antenna pattern for the array type assumed; i.e. linear, with equispaced radiators."*

Additionally, the authoritative *Handbook of Antenna Design*, Chapter 6, entitled "Multiple Beam Antennas", describes the MultiBeam Antenna (MBA) as follows:

"An MBA can be .....a planar array excited by a Butler beamforming network, or some variation and/or combination of these. Impressing a signal on one of the N ports produces a beam pointing in a direction unique to that port. The N beams produced by exciting each port individually define, or span the field of view (FOV) of the MBA. These beams are a fundamental basis for any radiation pattern produced by the antenna system."[2] (The Butler Matrix is another name for the passive, reciprocal, NxN matrix described in the present invention).

[1] J.L. Allen, "A Theoretical Limitation on the Formation of Lossless Multiple Beams in Linear Arrays", IRE Transactions on Antennas and Propagation, July 1961, page 350-352

Review of present Invention

In the Detailed Description of the present invention, and referencing Figure 3, the present invention is described as follows:

"*Each of the radio transceivers can be ported to a full duplex Ethernet switch port, providing dedicated, full duplex throughput at whatever data rate the radio transceiver and Ethernet switch will support*". (Page 5, Lines 25, 26, 27)

This means that each radio transceiver has a unique Network Address, as it is ported to a single Ethernet switch port. Note in the figure 3 that the number of Ethernet switch ports is identical to the number of radio transceivers.

Futhermore, the description of the present invention says-

"*There are switch ports on the Ethernet switch for each individual hub radio transceiver.*" (Page 6, lines 8, 9)

Which re-emphasizes that there is a unique Ethernet switch port and, consequently, a unique Network address for each radio transceiver.

The description of the present patent says that –

"*The hub radio transceivers provide the interface from the Ethernet to the multi-beam antenna assembly. The hub radio transceivers are connected to the beam-former of the multi-beam antenna assembly. The multi-beam antenna assembly generates directive beams in space, which are able to partially isolate the transmissions and receptions of each of the hub radio transceivers from one another*" (Page 6, Lines 13-18)

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[2] L.J. Ricardi "*Handbook of Antenna Design, Vol. I*" Published by Peter Peregrinus LTD, 1982. Chapter 6 pages

Again referencing figure 3, it can be seen that each antenna beam has a dedicated and unique switch port and, therefore, unique Network Address. This provides for a means of multiple access.

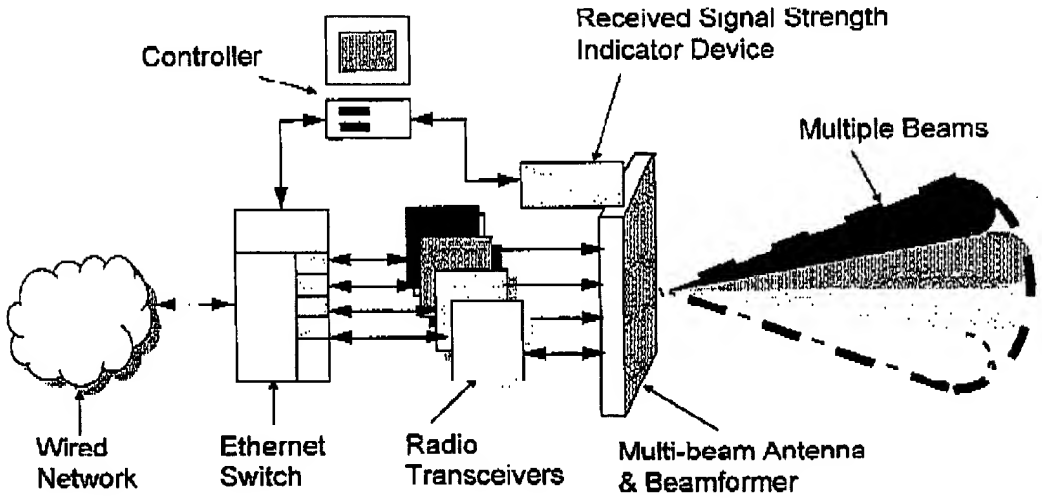


Fig. 3

Referencing figure 5, the present invention describes the use of fixed beam multi-beam antennas –

"Each mainlobe antenna beam is associated with an individual input port. As shown in figure 5, input port 18 is associated with mainlobe 36, input port 20 is associated with mainlobe 40, input port 22 is associated with mainlobe 34, input port 24 is associated with mainlobe 38". (Page 7, Lines 18-21)

and

"Each beam of the multiple beam antenna is associated with a single transceiver." (Page 7, Line 24,25).

This describes that each beam of the antenna, connected to a radio transceiver and an Ethernet switch port, has a dedicated and unique switch port, and consequently, each fixed antenna beam has a unique Network Address.

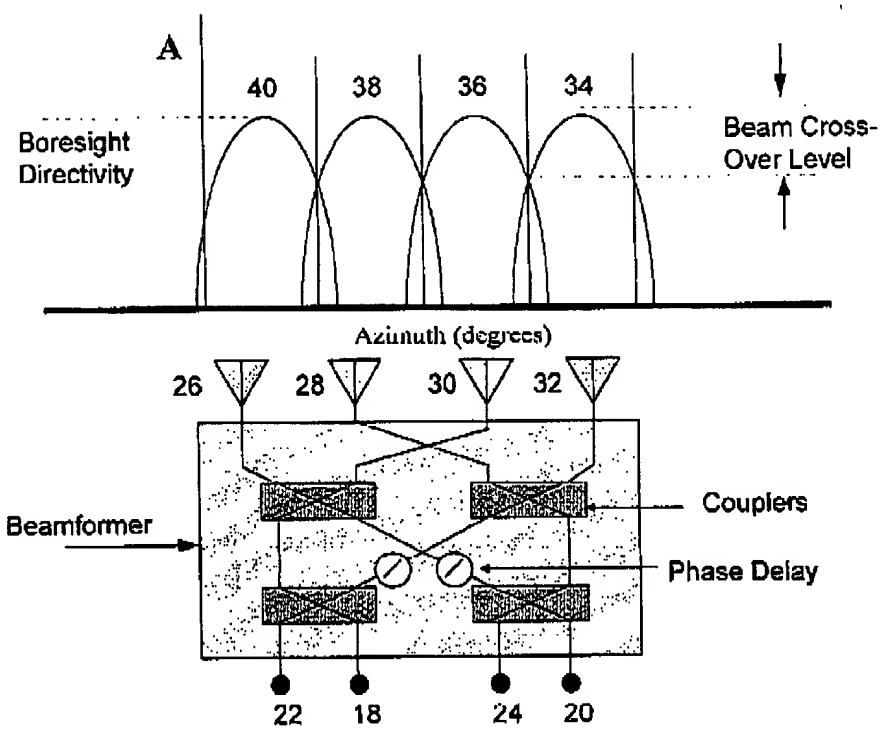


Fig. 5

Referencing figure 5, The Multibeam antenna is further described-

"As shown in figure 5, the Multibeam antenna at the hub generates N independent beams from N independent inputs, using a N x N hybrid coupling matrix beamformer" (Page 17, Lines 13-15)

and,

"In space, radiations from the individual radiators combine to form the individual beam patterns. The beam patterns 34, 36, 38, 40 formed by the radiators have directivity at a certain azimuthal postion. The beam patterns 34,36,38,40 overlap at a point in the beam pattern 34,36,38,40 called the beam crossover level." (Page 8, Lines 8-12)

The type of Multibeam antenna described herein has fixed (non-steerable), simultaneous beams in space, each with a Network Address. The Multi-beam antenna as described in the present

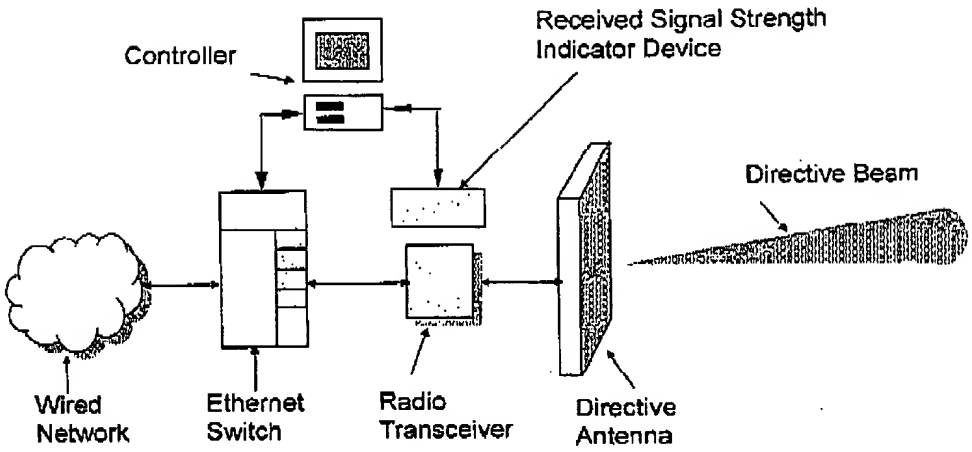
invention is not simply an antenna with multiple, adaptive beams as described by Zendle. Rather, it is a class of antenna with simultaneous beams, fixed in number, shape, and (azimuth, elevation) position.

Finally, referencing figure 4, the description of the present patent says-

"The remote station includes a remote station radio transceiver that is synchronized to communicate in the same frequency band with the associated hub receiver. The remote station radio transceiver interfaces a local network, which can be either through an Ethernet Switch, or directly into a wired network." (Page 6, Lines 25-30).

One knowledgeable in the operation of an Ethernet switch will recognize that when the hub Ethernet switch detects transmissions from the remote station, it adds the network address of the remote switch to that particular hub switch port's network address table. Likewise, when the remote station detects transmissions from the hub switch port, it adds the network address of that hub switch port to the remote switch's network address table.

The combination of fixed, simultaneous antenna beams and their respective dedicated switch port with unique network addresses is how the present patent automatically learns which beam the remote station is in, and automatically forwards data packets to the correct destination locations, simultaneously. This is a novel and unobvious solution.



REMOTE STATION

Fig. 4

The Examiner has rejected claims 2-3, 8-9, 11-14, 19, 26, 31-36 and 41-44 under 35 USC §103(a) for the reasons cited in the office action using the Zendle patent as the main reference with the addition of the Carnegie patent. Applicant respectfully requests reconsideration of these claims based on the following.

Regarding Claim 2 Zendle Col. 6 lines 47-54

Zendle describes the use of a "multi-service system" and "multi-service subscribers". The present invention does not describe a multi service system, but rather a method of multiple access using a multi-beam antenna. Zendle's description is unrelated to the present invention.

Regarding Claim 3

Zendle, on the other hand, never describes the use of an NxN Beam Former or antenna of the class called Multi-beam, as described by the present invention. In fact, Zendle never uses either of the words "Beamformer" or "Multi-beam". Zendle teaches away from the present inventions, as follows:

Zendle Col. 6 line 57-62,

"The hub site preferably includes one or more antennas to provide sectorized antenna beams to communicate with remote multi-service subscribers. The sector widths can be varied from about 15 to 90 degrees wide depending on subscriber density, desired operating range and required bandwidth." (col. 6 lines 57-62)

The use of one or more sector antennas teaches away from the present invention, which describes the use of a Beamformer and Multi-beam antenna. Zendle teaches that sector widths can be varied, which teaches away from the present invention, which describes fixed beams in space using a fixed NxN Beamformer.

Regarding Claim 8

1. Zendle Col. 6 line 47-51 & 63-65 & Col. 7 lines 2-9

The examiner states that Zendle teaches a multi-beam antenna. Again, Zendle never uses either of the words "Beamformer" or "Multi-beam". Zendle's use of the terms "multi-service system" or "multi-service subscriber" (col. 6, line 47-51 & col. 7 lines 2-9) should not be interpreted as a class of antennas called "Multi-beam" or "Beamformed" as described in the present invention.

2. Zendle Col. 7, lines 2-9 & 39-45 Zendle teaches that:

"The point to multipoint hub sites are generally interconnected by a backbone network, preferably a fiber optic network such as a SONET ring, or a microwave radio network joining each hub. The backbone network may preferably be a SONET based infrastructure utilizing a packet based protocol

such as ATM to switch and route customer traffic to destination points with in the network ATM is a packetized transmission technology which organizes information into cells."

Zendle teaches away from the present invention by teaching the use of SONET or ATM as a means of packet transport. The present invention describes the use of Ethernet packet switching as inherently the only means of information transport. In fact, the use of the Ethernet MAC address, aligned with a specific port on the Beamformer of the Multibeam antenna for multiple access, precludes the use of ATM or SONET in the present invention.

3. Zendle Col. 8 lines 3-25

Zendle states that "*Commercial customers such as business ....that are connected via millimeter wave wireless links to wide area networks also have access to a host of emerging broadband multimedia services. These include high speed Internet access, web hosting and information services, native LAN services such as Ethernet.....*"

Zendle describes Ethernet as a service that customers may have, NOT a core function of the patent. The present invention describes Ethernet as a core scheme for the systems multiple access, using the Ethernet MAC address dedicated to an antenna beam. In fact Zendle teaches away from the Ethernet multiple access concept by stating:

"*Preferably, the packetized data takes the form of Asynchronous Transfer Mode protocol data*" (Col.5 lines 41-42), and

"*In the above embodiments, it is preferable that the transceiver supports a multiple access protocol. One such protocol is time division multiple access.*" (Col. 5 lines 63-65).

4. Carnegie col. 7 lines 42-47

Carnegie describes a gateway resource to communicate with stations but does not teach anything about a method of multiple access as described in the present invention.

The Ethernet is taught by Carnegie as a protocol for transporting information between relay stations and supporting *multiple applications* (this is different from *multiple access* for multiple users), not as a means of automatically providing for multiple access using fixed beam antennas as described in the present invention. Carnegie actually teaches away from using the Ethernet switching technology for multiple access, by citing *multiple relay stations*. Carnegie also teaches away from the present invention by describing other protocols, all of which would preclude use of the present invention.

Regarding Claim 9

Zendle Col. 6 lines 49-56

The examiner erroneously states that Zendle teaches a radio connected to a Multi-beam antenna. Zendle only teaches that hub radios are only linked to other hub radios. This teaches away from the present invention.

Regarding Claim 11

Neither Zendle nor Carnegie teaches the use of the Ethernet switching as the multiple access methodology described by the present invention. They only teach Ethernet as a potential gateway resource for interconnection to a wide area network. The present invention describes Ethernet as a core scheme for the systems multiple access, using the Ethernet MAC address dedicated to an antenna beam.

Regarding Claim 12

The examiner erroneously states that Zendle teaches a radio connected to a Multi-beam antenna. Zendle only teaches that hub radios are only linked to other hub radios. This teaches away from the present invention.

Regarding Claim 13

Neither Zendle nor Carnegie teach the use of the Ethernet switch as the multiple access methodology described by the present invention

Regarding Claim 14

Zendle Col. 6 lines 57-62 and col. 7 lines 10-16)

Again, Zendle never describes use of a multi-beam antenna. Zendle is describing the use of sector antennas, which are not related to multi-beam antennas.

Regarding Claim 19

Zendle Col. 4 line 61-66

The present invention's claim 19 is for a Multi-beam antenna realized with radiating elements on a circuit board. Zendle describes a circuit board installed in a PC, perhaps with an integrated radio. Zendle does not describe the realization of a Multibeam antenna in any form.

Regarding Claim 26

Zendle Col. 7, line 13

The examiner erroneously states that Zendle teaches two non-adjacent beams of the plurality of beams are the same frequency (a claim of the present inventions). Actually, Zendle states something very different: "*the hub site assigns frequencies to adjacent sectors which are substantially separated from each other*" (Col.7 lines 11-13)

Regarding Claim 31

Again, the examiner erroneously states that Zendle teaches a Multi-Beam Antenna and Beamformer. Zendle never describes either the class of antennas called Multibeam, or the use of any kind of beamforming matrix, in particular, the fixed NxN beamforming matrix described in the present invention.

Indeed it would be obvious to one of ordinary skill in the art at the time to connect Ethernet to the hub to provide broadband multi-media service as stated by the examiner. The only requirement would be that the Hub would have an Ethernet port. However, it is not obvious that the MAC addressing scheme of the Ethernet switch could also be used to provide a form of spatial multiple access through the beamformer and Multibeam antenna. This requires additional hardware components (inventions) beyond an ethernet enabled hub, including:

1) the NXN beamformer
2) the "N" beam Multibeam antenna matched to the beamformer
3) "N" radio transceivers, which itself has an MAC address, and is able to impart the address into the packet header of the Ethernet packet.

Regarding Claim 32

1. Zendle Col. 6 lines 57-59

Again, neither Zendle nor Carnegie teaches the use of a beamformer. Neither teaches the use of an Ethernet MAC address for the purpose of multiple access through the multibeam antenna. Again, Zendle teaches the use of variable sector widths, which teaches away from the present inventions use of beams fixed in space by the use of the fixed NxN beamformer and multibeam antenna.

Regarding Claim 33

Same response as for Claim 2

Regarding Claim 34

Same response as for Claim 2

Regarding Claim 35

Again, Zendle never describes use of a multi-beam antenna. Zendle is describing the use of sector antennas, which are not related to multi-beam antennas.

Regarding Claim 36

Same response as for Claim 35

Regarding Claim 41

Same response as for Claim 31

Regarding Claim 42

Same response as for Claim 32

Regarding Claim 43

Same response as for Claim 35

Regarding Claim 44

Same response as for Claim 35

The Examiner has rejected claims 4-5, 10, 15-18, 20-25 and 27-28 under 35 USC §103(a) for the reasons cited in the office action using the Zendle patent as the main reference with the addition of the Carnegie and Dent patents. Applicant respectfully requests reconsideration of these claims based on the following.

Regarding Claim 4

Zendle, Col. 6 lines 57-59

The examiner erroneously states that Zendle and Carnegie teach a beamformer, which they do not. In particular, they do not teach the use of the present patents teaching of a NxN hybrid coupling matrix having N input ports and N radiating elements, wherein the value of N may be any radix 2 number.

Dent, Col. 9 lines 18-24

Dent describes an NXN power amplifier matrix for cellular systems- for achieving high power/low intermodulation transmission. This is unrelated to the present invention use of the NxX matrix to achieve multiple access.

"The power amplifier matrix can be a bank of n separate amplifiers each associated with respective beams , or a bank of N (greater or equal to n) amplifiers coupled by nXN Butler matrices at their inputs and Nxn Butler matrices at their outputs. The effect of the Butler matrices is to use each amplifier to amplify part of every beam signal, thus evening out the load...and reducing intermodulation". (Col. 9 lines 18-24)

Regarding Claim 5

Dent teaches the use of antenna beamformers in cellular (mobile) phone systems. Dent teaches away from the present invention by describing a beamformer (col.7 line 5-10) which samples and tracks moving telephones. The present invention is for stations fixed in space.

Regarding Claim 10 (Dent col. 9 lines 18-23)

Dent describes an NxN power amplifier matrix for cellular systems- for achieving high power transmission. This is unrelated to the present invention's use of the NxX matrix to achieve multiple access.

Regarding Claim 15 (Dent col. 3 lines 1-5)

Dent describes signal strength measurements from a satellite. This is unrelated to the present patent.

Regarding Claim 16 (Dent col. 23 lines 61-67 & col. 24 lines 1-3)

The cited references are not related to the present invention.

Regarding Claim 17 (Dent col. 41 lines 42-49)

Dent does not describe the use of the received signal strength to adjust the transmit power in a beam of a multi-beam antenna in this cited reference.

Regarding Claim 18 (Dent col. 13 lines 45-49. & col. 41 lines 42-49)

The cited references appear not to be related to the per packet power control described by the present invention.

Regarding Claim 20

Zendle and Carnegie do not teach a system comprised of a multi-beam antenna, of micr-strip or any other form of construction.

Dent col. 12 lines 13-15- Dent describes a VCO coupling network using hybrid couplers. This is unrelated to the present invention.

Regarding Claim 21 col. 7 lines 50-55 and col. 8 lines 20-25

In the cited references, Dent does not describe a source which is linked to a multi-beam antenna.

Regarding Claim 22

Zendle col. 6 lines 47-62

Zendle does not teach the use of the multi-beam antenna connected to a radio transceiver.

Regarding Claim 23

Same response as Claim 10

Regarding Claim 24

Dent col. 24 lines 7-11

"Then the removed row of C is used to augment in turn each of the C matrices associated with other groups of mobiles using different frequency channel (FDMA) or multi-carrier (CDMA) or timeslots (Time Div. Multiple Access) and the above expressions computed to determine the increase in power that would be necessary to support the mobile as a member of each of the other groups in turn". (Col. 24, lines 7-17).

Dent describes dynamic matrices (C-matrices) serving mobile stations using three different forms of multiple access (Freq. Div. multiple access, Code Div. Multiple Access, Time Div. Multiple Access). The present invention uses a static hybrid matrix to serve stationary stations, using the Ethernet network address table for spatial multiple access. Dent is teaching away from the present invention.

Regarding claim 25 (Dent col 45, lines 63-66)

Dent describes optimization of peak gain and use of a 3 dB beamwidth crossover point for mobile cellular systems, and he states that "*it is well known that this* (-3 dB) *does not result in maximum beam edge gain. A higher gain is achieved if the beam is narrowed, which increase the peak gain more than the edge loss experienced*".

Conversely, the present invention prescribes that the remote station remain within the 3 dB beamwidth of the multi-beam antenna.

Regarding claim 27 (Dent col 4, lines 1-5)

Dent does not describe reduction in sidelobes in cited reference

Regarding claim 28 (Zendle col 8, lines 35-40 & 48-52)

Zendle does not describe the use of different polarizations in the antenna in the cited reference

The Examiner has rejected claims 6-7 under 35 USC §103(a) for the reasons cited in the office action using the Zendle patent as the main reference with the addition of the Carnegie, Dent and Niki patents. Applicant respectfully requests reconsideration of these claims based on the following.

Regarding claim 6

As noted previously, Zendle teaches use of a PC card for a network interface, not as a beamformer or multi-beam antenna.

Petry (col. 3 lines 15-17) describes beamforming networks which "*produce any radiation lobe desired with regard to direction or opening angle or beam angle*". This teaches away from the present invention, which describes N fixed beams in space, determined by the fixed NxN beamformer, with "N" radio transceivers.

Niki (col. 1 lines 55-58) only teaches a means of creating a circuit- not a means of creating wireless spatial multiple access through a multibeam antenna.

Regarding claim 7

Same response as claim 6

Regardless of whether the beamformer and multi-beam antenna are realized as microstrip or stripline circuits, neither Zendle, Carnegie, Petry or Niki suggest that these circuits, when realized as a N beam multi-beam antenna, NxN beamforming matrix, with "N" Ethernet enabled radio transceivers, and an N port Ethernet switch in combination, create a form of spatial multiple access

Hence, applicant believes that the rejection of claims 2-29, 31-36, and 40-44 under U.S.C. § 103(a) is invalid, as the references actually teach away from the invention as claimed. Applicant believes that due to the lack of proper teachings in the referenced patents, the Examiner has not met the duty to show the incentive to combine the teachings of the reference under the U.S.C. § 103(a) rejection to produce the invention as claimed. In *Ex parte* Skinner, 2 USPQ2d, 1788, 1790 (B.P.A.I. 1986), The Board explained:

> When the incentive to combine the teachings of the reference is not readily apparent, it is the duty of the examiner to explain why combination of the reference teachings is proper....Absent such reason or incentives, the teachings of the references are not combinable.

In view of the aforementioned remarks and amendments, it is believed that claims 2-29, 31-36, and 40-44 are in condition for allowance and allowance of these claims is respectfully requested.

Respectfully submitted,

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